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## ALGEBRA.

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96. Proposed by F. M. PRIEST, Mona House, St. Louis, Mo.

How many different numbers may be written with the nine digits and zero, using them singly and in groups of from two to ten digits each, and using no figure but once in each group? How many more numbers may be written by repeating the digits and zero at pleasure in each group?

97. Proposed by F. M. SHIELDS, Coopwood, Miss.

A farmer had 2080 pounds of grain at the depot, and gave a wagoner .75 cents per 100 pounds to haul it, paying him in the *same* grain at the following prices, viz.: 3-10 of the hauling bill was paid in corn at .58 cents per bushel of 56 pounds. 3-5 was paid in wheat at 1.55 cents per bushel of 60 pounds, and the balance of the bill was paid in oats at .36 cents per bushel of 32 pounds, the wagoner not charging for hauling his own grain. The load being delivered, how many bushels of each kind of grain did the wagoner get, and how many bushels of each kind did the farmer have left after paying the wagoner?

\*\*\* Solutions of these problems should be sent to J. M. Colaw not later than April 10.

## GEOMETRY.

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116. Proposed by P. S. BERG, A. M., Superintendent of Schools, Larimore, N. D.

Inscribe by rule and compass a regular heptadecagon.

117. Proposed by GUY B. COLLIER, Schenectady, N. Y.

If  $(x', y')$  and  $(x'', y'')$  are the extremities of a pair of conjugate diameters whose eccentric angles are  $\varphi'$  and  $\varphi$ , show that  $\varphi' + \varphi = 90^\circ$ ; given  $(x', y') = (a \sec \varphi', b \tan \varphi)$ . [From Nichols' *Analytical Geometry*.]

\*\*\* Solutions of these problems should be sent to B. F. Finkel not later than April 10.

## MECHANICS.

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84. Proposed by J. SCHEFFER, A. M., Hagerstown, Md.

Two weights  $P$  and  $Q$  are fastened by a weightless string that is strung over a single movable pulley.  $P$  is greater than  $Q$ . The weight of the pulley is  $2R$ . Find the tension of the string, (1) when the friction of the string on the pulley is neglected, (2) when it is considered.

85. Proposed by WILLIAM HOOVER, A. M., Ph. D., Professor of Mathematics and Astronomy, Ohio State University, Athens, Ohio.

A circular tube of radius  $a$  revolves uniformly about a vertical diameter with angular velocity  $\sqrt{\frac{ng}{a}}$ , and a particle is projected from its lowest point with such velocity that it can just reach the highest point; prove that the time of describing the first quadrant is  $\sqrt{\frac{a}{(n+1)g}} \log(\sqrt{n+2} + \sqrt{n+1})$ .